



RAILROAD COMMISSION OF TEXAS

HEARINGS DIVISION

OIL AND GAS DOCKET NO. 06-0279278

COMMISSION CALLED HEARING TO CONSIDER THE COMPLAINT OF JAMES PERKINS AND CHARLES HASSELL REGARDING THE IMPROPER GAS WELL CLASSIFICATION FOR THE MINA LEASE, WELL NO. 1A, MAYDELL (WOODBINE) FIELD, CHEROKEE COUNTY, TEXAS

HEARD BY: Richard D. Atkins, P.E. - Technical Examiner
Laura Miles-Valdez - Legal Examiner

APPEARANCES: **REPRESENTING:**

COMPLAINANTS:

George C. Neale
Cary McGregor

James Perkins and Charles Hassell

RESPONDENT:

Mickey R. Olmstead
Thomas H. Richter
Keith Foree
Steve Adam

Aeon Operating, Inc.

PROCEDURAL HISTORY

Complaint Filed:	November 14, 2012
Notice of Hearing:	March 28, 2013
Hearing Held:	May 29, 2013
Transcript Received:	June 17, 2013
Proposal for Decision Issued:	October 1, 2013

EXAMINERS' REPORT AND PROPOSAL FOR DECISION

STATEMENT OF THE CASE

Statewide Rule 79 defines a gas well as "...A well which produces hydrocarbon liquids, a part of which is formed by a condensation from a gas phase and a part of which is crude petroleum oil, shall be classified as a gas well unless there is produced one barrel or more of crude petroleum oil per 100,000 cubic feet of natural gas; and that the term

“crude petroleum oil” shall not be construed to mean any liquid hydrocarbon mixture or portion thereof which is not in the liquid phase in the reservoir, removed from the reservoir in such liquid phase, and obtained at the surface as such.” The examiners believe that the liquid hydrocarbons in this reservoir are immobile, and therefore any liquid produced at the surface does not meet the definition of “crude petroleum oil”. Instead, the produced liquid is a product of condensation and should not be used as a basis for classification of the well as an oil well.

According to McCain, there is a sharp dividing line between the chemical composition of oils and condensates.¹ In McCain's study on hundreds of wells that were properly conditioned and tested, the mole % of heptanes-plus were compared to the PVT analysis of fluids from each well to determine whether the reservoir exhibited a dew point (gas well) or bubble point (oil well). From this study, it was found that fluids with over 12.5 mole % heptanes-plus exhibited bubble points while fluids with less than 12.5 mole % heptanes-plus exhibited dew points.

The complainants, James Perkins and Charles Hassell (“Perkins & Hassell”), allege that the Commission has improperly classified the Mina Lease, Well No. 1A, as a gas well. The respondent, Aeon Operating, Inc. (“Aeon”) believes that the subject well is completed in a retrograde condensate gas reservoir and should be classified as a gas well. The examiners recommend that the subject well remain classified as a gas well, which is supported by the Moses and McCain papers that are the basis for the Commission staff's 2006 heptanes-plus policy.

DISCUSSION OF EVIDENCE

The Maydell (Woodbine) Field was discovered in February 1956 at an average depth of 4,700 feet. The field is classified as associated with the allocation formula suspended so that all wells are authorized to produce at absolute open flow or 100% AOF status. There are 2 producing gas wells and 2 operators carried on the proration schedules. The field operates under Statewide Field Rules. Cumulative production from the field through July 2013 is 487.0 MMCFG and 108.0 MBO.

The Mina Lease, Well No. 1A, was completed in February 2009 in the Maydell (Woodbine) Field, with perforations between 4,712 feet and 4,714.5 feet. On initial test, the well produced at a maximum rate of 188 MCFGPD, 0 BOPD and 0 BWPD with no gas-oil ratio. Cumulative production from the well through February 2013 is 301.9 MMCFG and 85.8 MBO with an average gas-oil ratio of 3,519 cubic feet per barrel. There is one other gas well, the Paleo, Inc. - Barbara Carter Lease, Well No. 1, currently carried in this associated gas field that is located approximately 1.5 miles south of Well No. 1A.

¹ McCain, William D, 1990, The Properties of Petroleum Fluids.

In the spring of 2012, the Commission staff was concerned that the well needed to be classified as an oil well and requested that the operator, TX Lone Star Operating Co., LLC ("Lone Star"), file a Form W-2 to justify why the well was classified a gas well. On August 8, 2012, Lone Star filed a Form W-2 reclassifying the well to an oil well. On the potential test, the well produced at a maximum rate of 80 BOPD, 110 MCFGPD and 480 BWPD with a gas-oil ratio of 1,375 cubic feet per barrel. To verify the new classification, Lone Star had their contract pumper collect a separator sample of the gas and oil, as instructed by Gas Analytical Solutions, Inc ("Analytical").

On September 27, 2012, the contract pumper collected and delivered the samples for a recombined wellstream analysis to Analytical. At the time of sampling, the producing gas-oil ratio was 1,522 cubic feet per stock tank barrel and the stock tank oil gravity was 48.8 degrees API. Analytical calculated the mol % of heptanes-plus to be 8.399, which would qualify the well to administratively be classified as a gas well under Commission staff's policy. The Mina Lease, Well No. 1A, was administratively granted a permanent gas well classification by Commission staff on November 13, 2012.

Perkins & Hassell's Evidence

Perkins and Hassell's engineering expert alleges that the sample taken on September 27, 2012, should not have been accepted by Commission staff, because it was taken by Lone Star's contract pumper. Commission staff's policy clearly states that "...fluid sampling for compositional analysis should be performed by a third party who certifies that the sample is representative of the reservoir fluid and has identical properties to those of a fluid taken from the subject reservoir on the same day". The expert felt that, since the samples were collected by Lone Star's contract pumper and not Analytical, they should be rejected.

The engineering expert submitted a production history graph for the Mina Lease, Well No. 1A, from February 2009 to February 2013. The gas-oil ratio was initially 300,000 cubic feet per barrel and had fallen to as low as 500 cubic feet per barrel. The average since September 2010 had been approximately 2,000 cubic feet per barrel. The expert opined that the gas-oil ratio was indicative of a gas cap that was being invaded by an oil column. If the subject well was in a retrograde gas condensate reservoir, then one would expect the gas-oil ratio to be increasing as the liquids were condensed in the reservoir and became immobile.

Perkins and Hassell contracted FESCO, Ltd. ("FESCO") to resample the Mina Lease, Well No. 1A. The first sample was taken on March 8, 2013, and the producing gas-oil ratio was 1,333 cubic feet per stock tank barrel and the stock tank oil gravity was 43.4 degrees API. FESCO calculated the mol % of heptanes-plus to be 23.8, which is indicative of a oil well classification. A second sample was taken on March 22, 2013, and the producing gas-oil ratio was 805 cubic feet per stock tank barrel and the stock tank oil gravity was 45.2 degrees API. FESCO calculated the mole % of heptanes-plus of this sample to be 29.4, which is also indicative of an oil well classification.

The engineering expert submitted a graph of the initial producing gas-oil ratio versus mole % of heptanes-plus for the wells contained in McCain's study. The graph was a hyperbolic curve that ranged from a 6,000 gas-oil ratio and a mole % of heptanes-plus of 7.5 down to a 1,000 gas-oil ratio and a mole % of heptanes-plus of 22.5. All of the wells above a gas-oil ratio of 3,200 and below a mole % of heptanes-plus of 12.5 had dew points and would be classified as gas wells. Most of the wells below a gas-oil ratio of 3,200 and above a mole % of heptanes-plus of 12.5 had bubble points and would be classified as oil wells.

The engineering expert had plotted the three compositional analysis points obtained from the recent September 2012 and March 2013 samples. The two FESCO samples were in close proximity of McCain's plot and were below a gas-oil ratio of 3,200 and above a mole % of heptanes-plus of 12.5, which would classify the Mina Lease, Well No. 1A, as an oil well. The Analytical sample was an outlier point that was below McCain's plot in the lower left-hand corner of the graph. The expert felt that something was wrong with either the gas-oil ratio or the mole % of heptanes-plus that was used in Analytical's recombined wellstream analysis.

The engineering expert submitted a type log for the Mina Lease, Well No. 1A. The expert felt that the resistivity and porosity curves clearly indicated a reservoir with a gas cap and oil column that was underlain by a water column. The top of the reservoir and gas cap was at 4,712 feet, the top of the oil column was at 4,724 feet and the top of the water column was at 4,730 feet. The well is perforated from 4,712 feet to 4,714.5 feet, which would be at the top of the reservoir in the gas cap.

The expert opined that the reservoir description shown on the log fit the character of the well's performance. Initially, the well began producing with a very high gas-oil ratio with no liquids, since the well is completed in the gas portion of the reservoir. As the well started coning in oil, the gas-oil ratio began to rapidly decline, which is the opposite of a retrograde gas condensate reservoir. As the oil was produced, there was a period of two years when the well produces at a gas-oil ratio of 2,000 cubic feet per barrel. During this time, the well began to experience rapidly increasing water production, which ranged between 500 and 600 BWPD.

Aeon's Evidence

Aeon's contract pumper stated that he pumps about 20 wells for about seven operators in the surrounding area. He was also the pumper of the Mina Lease, Well No. 1A, for the previous operator, Lone Star, and considers himself to be an independent contractor. He met with Analytical several times to discuss the sampling procedure and used their sample bottles. The pumper took his first samples at the compressor site and was told by Analytical that the sample was not useable.

After researching the sampling procedure and meeting again with Analytical, he discovered that the well needed to be stabilized and the samples taken at the separator. Prior to the September 2012 sampling, the pumper stated that the well's production characteristics had been stable for some time. The well was producing "flatlined" at approximately 100 to 125 MCFGPD, 60 to 80 BCPD and the tubing pressure was holding right at 320 psi. The pumper testified that he sampled the well and delivered the samples directly to Analytical for analysis and at no time did Lone Star exercise any control over the sampling procedure established by himself and Analytical.

After the sampling in September 2012, the well began to load up and quit flowing and had to be swabbed several times in October through December. The main production problem was that the well was producing intermittently in surges, filling up the separator, flowing over into the production equipment and shutting the well down, since there was not enough gas to operate the dump valves and keep the compressor running. To keep the well flowing, the pumper installed a recirculating system. The system would allow the compressor to continue to run and as the tubing pressure fell to about 50 psi the well would have time to build tubing pressure and come back around to be able to dump the fluids. Since the well was not stabilized for the FESCO sampling in March, the pumper was concerned that the samples taken by FESCO should not be used for the recombined wellstream analysis. The pumper stated, that during both samples, the well's tubing pressure varied from 50 psi up to 300 psi.

Aeon's engineering expert submitted an area map and cross-section for the two Woodbine formation fields. The Mina Lease, Well No. 1A, and the Paleo, Inc. - Barbara Carter Lease, Well No. 1, were shown in the Maydell (Woodbine) Field. Approximately 4 miles to the northeast, there were two plugged gas wells that had been carried in the Maydell, N. (Woodbine) Field. The expert believed that all of the wells in the two fields were in the same Woodbine formation and had always been classified as gas wells.

The expert examined the well logs of both the Mina Lease, Well No. 1A, and the Barbara Carter Lease, Well No. 1. He noted that the porosity cross-over, as well as the dual induction log character were almost identical in both wells. The wells were completed in the same way with only several feet of perforations at the top of the reservoir. The expert felt that the dual induction log curve shows a gas or gas condensate zone transitioning into a water zone. He believed that the log curve was relatively constant in the gas zone and then declined straight line into the water zone. If there was a true oil leg, he felt that the log curve would flatten out and be steady for a few feet, then decline into the water zone, but that did not occur.

Aeon's engineering expert submitted a Journal of Petroleum Technology paper detailing the phase behavior of crude oil and condensate systems² and an American Petroleum Institute paper dealing with the sampling of petroleum reservoir fluids.³ The papers state that sampling procedures and well conditioning is especially important when the reservoir fluid is at or near its dew point pressure at the prevailing reservoir conditions. Any reduction in pressure near the wellbore from a producing well will alter the composition of the fluid flowing into the wellbore. If sampling is delayed until the static reservoir pressure drops below the dew point pressure of the original reservoir fluid, representative samples of the original fluid can no longer be obtained. Likewise, any errors in the gas-oil ratio measurement will be reflected in the recombination calculations and can prevent laboratory personnel from properly reconstituting the reservoir fluid. The expert felt that these problems provide a strong incentive for sampling early in the life of a reservoir, especially since the actual dew point pressure will not be conclusively known until the samples have been taken for studies.

Aeon's engineering expert examined Woodbine formation oil reservoirs in the area to compare the oil gravities to the Mina Lease, Well No. 1A. The closest oil field was over 4.5 miles from the Maydell (Woodbine) Field. The expert found that the Woodbine formation oil fields had oil gravities ranging from 28 up to 39.8 degrees API. The two closest oil fields, the Neches, East (Woodbine) and the Charles S. Cook (Woodbine) Fields, were 34.2 and 28 degrees API, respectively. The expert opined that the Woodbine oil fields have oil gravities almost 10 degrees API gravity less than the Mina Lease, Well No. 1A, which had been reported at 48.8 degrees API during the September 2012 sampling.

Aeon's engineering expert's position is that it's too late in the life of the Mina Lease, Well No. 1A, to properly do a heptanes-plus test, which is supported by the Moses and McCain papers which are the basis for the Commission's 2006 heptanes-plus policy. The expert felt that, if any test was valid, it would be the September 2012 test that was sampled by the contract pumper who was the only person out on location for any of the tests. Aeon believes that the contract pumper qualifies as a third-party independent contractor capable of collecting samples under Analytical's direction and guidance.

Aeon believes that it's clear the Mina Lease, Well No. 1A, is surrounded by offsetting Woodbine retrograde condensate gas reservoir wells that are completed in the same reservoir. In addition, the gas wells are all completed almost identically and have similar production characteristics. The wells initially produced only dry gas and then began increasing in condensate production. Later in the wells' life, the condensate production

² Moses, Phillip L, 1986, Engineering Applications of Phase Behavior of Crude Oil and Condensate Systems.

³ American Petroleum Institute, 2003, Sampling Petroleum Reservoir Fluids, Recommend Practice 44.

rate began to subside and eventually terminate all together. The expert opined that he had presented an exhaustive analysis showing that the Maydell (Woodbine) Field is a retrograde condensate gas reservoir and the Mina Lease, Well No. 1A, should be properly classified as a gas well.

EXAMINERS' OPINION

The examiners agree with the industry papers submitted that indicate that sampling procedures and well conditioning is especially important when the reservoir fluid is at or near its dew point pressure at the prevailing reservoir conditions. Any reduction in pressure near the wellbore from a producing well will alter the composition of the fluid flowing into the wellbore. If sampling is delayed until the static reservoir pressure drops below the dew point pressure of the original reservoir fluid, representative samples of the original fluid can no longer be obtained. Likewise, any errors in the gas-oil ratio measurement will be reflected in the recombination calculations and can prevent laboratory personnel from properly reconstituting the reservoir fluid. These problems provide a strong incentive for sampling early in the life of a reservoir, especially since the actual dew point pressure will not be conclusively known until the samples have been taken for studies.

Prior to the September 2012 sampling, the pumper stated that the well's production characteristics had been stable for some time. The well was producing "flatlined" at approximately 100 to 125 MCFGPD, 60 to 80 BCPD and the tubing pressure was holding right at 320 psi. The pumper testified that he sampled the well and delivered the samples directly to Analytical for analysis and at no time did Lone Star exercise any control over the sampling procedure established by himself and Analytical.

Based on the evidence, it is too late in the life of the Mina Lease, Well No. 1A, to properly do a heptanes-plus test. This conclusion is supported by the Moses and McCain papers which are the basis for the Commission's 2006 heptanes-plus policy. If any test is valid, it is the September 2012 test that was sampled by the contract pumper who was the only person out on location for any of the tests. The contract pumper qualifies as a third-party independent contractor capable of collecting samples under Analytical's direction and guidance.

After the sampling in September 2012, the well begin to load up and quit flowing and had to be swabbed several times in October through December. The main production problem was that the well was producing intermittently in surges, filling up the separator, flowing over into the production equipment and shutting the well down, since there was not enough gas to operate the dump valves and keep the compressor running. To keep the well flowing, a recirculating system was installed that allowed the compressor to continue to run allowing the dump valves to operate and dump fluids. During both FESCO samples, the well's tubing pressure varied from 50 psi up to 300 psi. Since the well was not stabilized for the FESCO sampling in March, the samples taken by FESCO are unreliable and should not be used for the recombined wellstream analysis.

The well logs of both the Mina Lease, Well No. 1A, and the Barbara Carter Lease, Well No. 1, have porosity cross-over, as well as the dual induction log character, that are almost identical. The wells were completed in the same way with only several feet of perforations at the top of the reservoir. The dual induction log curve shows a gas or gas condensate zone transitioning into a water zone and the log curve is reasonably constant in the gas zone and then declines straight line into the water zone. If there was a true oil leg, the log curve would flatten out and be steady for a few feet, then decline into the water zone, but the log does not reflect this.

The Woodbine formation oil fields have oil gravities ranging from 28 up to 39.8 degrees API. The two closest oil fields, the Neches, East (Woodbine) and the Charles S. Cook (Woodbine) Fields, are 34.2 and 28 degrees API, respectively. The Woodbine oil fields have oil gravities almost 10 degrees API gravity less than the Mina Lease, Well No. 1A, which tested at 48.8 degrees API during the September 2012 sampling.

The examiners believe the Mina Lease, Well No. 1A, is surrounded by offsetting Woodbine retrograde condensate gas reservoir wells that are completed in the same reservoir. In addition, the gas wells are all completed almost identically and have similar production characteristics. The wells initially produced only dry gas and then began increasing in condensate production. Later in the wells' life, the condensate production rate subsides and eventually terminates all together. Aeon did an exhaustive analysis that establishes that the Maydell (Woodbine) Field is a retrograde condensate gas reservoir and the examiners recommend that the Mina Lease, Well No. 1A, in the Maydell (Woodbine) Field, Cherokee County, Texas, be permanently classified as a gas well, as administratively determined by Commission staff on November 13, 2012.

FINDINGS OF FACT

1. Notice of this hearing was provided to all persons entitled to notice at least ten (10) days prior to the date of the hearing.
2. The Maydell (Woodbine) Field was discovered in February 1956 at an average depth of 4,700 feet.
 - a. The field is classified as associated with the allocation formula suspended so that all wells are authorized to produce at absolute open flow or 100% AOF status.
 - b. There are 2 producing gas wells and 2 operators carried on the proration schedules.
 - c. The field operates under Statewide Field Rules.
3. The Mina Lease, Well No. 1A, was completed in February 2009 in the Maydell (Woodbine) Field, with perforations between 4,712 feet and 4,714.5 feet.

- a. On initial test, the well produced at a maximum rate of 188 MCFGPD, 0 BOPD and 0 BWPD with no gas-oil ratio.
 - b. There is one other gas well, the Paleo, Inc. - Barbara Carter Lease, Well No. 1, currently carried in this associated gas field that is located approximately 1.5 miles south of Well No. 1A.
4. The Mina Lease, Well No. 1A, should be permanently classified as a gas well because it produces from a retrograde condensate gas reservoir.
- a. If sampling is delayed until the static reservoir pressure drops below the dew point pressure of the original reservoir fluid, representative samples of the original fluid can no longer be obtained.
 - b. During both FESCO, Ltd. ("FESCO") samples, the well's tubing pressure varied from 50 psi up to 300 psi.
 - c. Since the well was not stabilized for the FESCO sampling in March 2013, the samples taken by FESCO are unreliable and should not be used for the recombined wellstream analysis.
 - d. Prior to the September 2012 sampling, the well's production characteristics had been stable for some time. The well was producing "flatlined" at approximately 100 to 125 MCFGPD, 60 to 80 BCPD and the tubing pressure was steady at 320 psi.
 - e. On September 27, 2012, Aeon Operating, Inc.'s ("Aeon") contract pumper collected and delivered the samples for a recombined wellstream analysis to Gas Analytical Solutions, Inc ("Analytical").
 - f. At the time of sampling, the producing gas-oil ratio was 1,522 cubic feet per stock tank barrel and the stock tank oil gravity was 48.8 degrees API.
 - g. The mole % of heptanes-plus was calculated to be 8.399, which would qualify the well to administratively be classified as a gas well under Commission staff's policy under which any well with a mole % of heptanes-plus of less than 11 is classified as a gas well.
 - h. The Mina Lease, Well No. 1A, was administratively granted a permanent gas well classification by Commission staff on November 13, 2012.

- i. The Mina Lease, Well No. 1A, is surrounded by offsetting Woodbine retrograde condensate gas reservoir wells that are completed in the same reservoir. In addition, the gas wells are all completed almost identically and have similar production characteristics.
 - j. The well logs of both the Mina Lease, Well No. 1A, and the Barbara Carter Lease, Well No. 1, have porosity cross-over, as well as the dual induction log character, that are almost identical.
 - k. The dual induction log curve shows a gas or gas condensate zone transitioning into a water zone and the log curve was reasonably constant in the gas zone and then began to decline straight line into the water zone.
 - l. The Woodbine oil fields have oil gravities almost 10 degrees API less than the Mina Lease, Well No. 1A, which tested at 48.8 degrees API during the September 2012 sampling.
 - m. Liquid hydrocarbon production at the surface from the subject well is the product of condensation and should not be classified as crude petroleum oil.
 - n. Because the liquids produced from the well with natural gas are not crude petroleum oil, the subject well should be classified as a gas well.
5. Aeon's contract pumper works for about seven operators in the surrounding area and is an independent contractor. The contract pumper qualifies as a third-party independent contractor capable of collecting samples under Analytical's direction and guidance.

CONCLUSIONS OF LAW

- 1. Proper notice of this hearing was issued.
- 2. All things have been accomplished or have occurred to give the Commission jurisdiction in this matter.
- 3. The Mina Lease, Well No. 1A, in the Maydell (Woodbine) Field, Cherokee County, Texas, is a gas well based on the definition of a gas well pursuant to Statewide Rule 79 (a) (11) (C) and there is currently no reason to believe the producing characteristics of the well will change significantly in the foreseeable future.

RECOMMENDATION

Based on the above findings of fact and conclusions of law, the examiners recommend that the Mina Lease, Well No. 1A, in the Maydell (Woodbine) Field, Cherokee County, Texas, be permanently classified as a gas well, as administratively determined by Commission staff on November 13, 2012.

Respectfully submitted,



Richard D. Atkins, P.E.
Technical Examiner



Laura Miles-Valdez
Legal Examiner